A31

and insulation of the fuel cell bearing enclosure, as well as the controlled transfer of heat generated, are of great importance.

The paragraph numbering is that used in the published application. A copy of the amended abstract and paragraphs showing the changes is enclosed.

Remarks

The abstract has been amended to correct an oversight whereby the expressions "above" and "below" have been inadvertently transposed. It should be clear from a review of the application that the oversight was inadvertent and that the amendment renders the abstract consistent with the application.

Paragraph [0045] has been amended to correct an error in the publication of the application pursuant to which the expression "R_{TC}" was published as "RTC".

Paragraph [0046] has been amended to correct an inaccuracy in the formula for thermal resistance and the value derived using that formula. As the formula is one that would be understood by a person skilled in the science of heat transfer it is respectfully submitted that the amendments merely correct so as to be consistent with established scientific principles and do not add new matter to the application.

Paragraph [0072] has been amended to delete a sentence referring to operating temperatures of fuel cell devices. Upon further review it was determined that the information was inaccurate. As the information describes devices to which the invention may be applied rather than the invention itself, and as such devices are prior art devices, it is respectfully submitted that the amendment clarifies rather than extends the scope of the application and is a proper amendment.

Applicant looks forward to confirmation that the above amendments have been entered.

Respectfully submitted,

GOROKHOVSKY, Vladimir

Peter Milne
Registration No. 34534

PM:hcu

Enc.

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MARKED-UP TEXT SHOWING AMENDMENTS

U.S. PATENT APPLICATION NO. 09/847,353

Abstract

A heat transfer regulating mixture having a metallic component A with a melting point T_A and a particulate ceramic component B which is non-wettable by the metallic component A, non-reactive therewith and which has a melting temperature T_B which is higher than both the temperature T_A and a desired operating temperature T_D which is also higher than T_A. The metallic component A and the particulate ceramic component B and the respective amounts will typically be selected to have a higher thermal resistivity below [above] T_A than above [below] T_A. The heat transfer regulating mixture may be incorporated in a thermal flux regulator having the mixture within an enclosure surrounding a heat generating reactor structure.

Paragraph [0045]

In the instance of depositing a microcrystalline layer of diamonds on a particular substrate the selected substrate depositing temperature T_D is around 900°C. The substrate is in contact or is encased, except for the depositing surface, by a mixture of a metal or alloy having melting point between 200°C and 700°C, and ceramic particles, such as alumina, TiN, SiO_2 in the form of sand or quartz, or a mixture of these substances. Other ceramic particles which may be suitable as a component of the two-phase mixture of the present invention include boron nitride, boron carbide, silicon carbide, titanium carbide, high melting carbonitrides and oxynitrides, or chemical equivalents, and mixtures of such. The metal-ceramic particle mixture provides a semi-solid paste, or a highly viscous liquid bearing suspended solid particles, when in contact with the substrate at the temperature of the vapour deposition process, such as deposition of diamonds. When the heat is removed too fast, or the substrate temperature drops below the desired temperature, the two-component mixture freezes or solidifies, leading to poor or uneven contact between the mixture and the substrate. The effect on the heat removed, of the melting temperature of the lower melting component in the two-phase mixture in the neighbourhood of its melting point, is shown

schematically in Fig.1a, where [RTC] $\underline{R_{TC}}$ is the thermal contact resistance of the two component mixture, expressed as watts per cm^2 (w/cm^2), and T_A is the melting point of the lower melting component, usually a metal. It can be seen that the thermal resistance has a low value when the mixture in thermal contact with the substrate, is composed of a liquid metal and a suspension of ceramic particles, resulting in high heat flux. The high heat flux lowers the temperature of the substrate in contact with the mixture, leading to the freezing of the mixture, thus severing contact between the mixture and the substrate, thereby increasing the thermal resistance and lowering the value of heat flux, or the rate of heat transfer per unit area. Lower heat flux or lower rate of heat transfer from the substrate results in an increase in the substrate temperature, which in turn, leads to the remelting of the two-component mixture and to the restoration of heat removal rate to the previous level. Thus the heat flux from the substrate, and hence the substrate temperature (T_{st}), will oscillate around an average value T_P, between the depositing temperature T_D and the melting point T_A, of the metallic component of the two-phase mixture, as shown schematically in Fig.1b, and can be described by the inequality $T_A<T_P<T_D$.

Paragraph [0046]

In the preferred embodiment of the invention, the substrate has a portion of its surface pre-treated to be able to receive the vapour deposited species. The pre-treatment usually includes mechanical and conventional cleaning process steps, and other known treatments to render the substrate surface receptive of the deposited species. The substrate is usually mounted in a substrate holder or mount, supported on a base or housing, which is immersed in an atmosphere containing the vapour to be deposited. As discussed above, the substrate is encased or is surrounded below the pre-treated portion of the surface, by a physical mixture of a low melting point metal or alloy and small sized particles of a ceramic material. The base supporting the substrate is usually made of metal, which represents the first stage of a conventional heat sink. Depending on the dimensions and on the nature of the base, the first stage of the heat sink has a certain thermal resistance, R_1. In the most simple case, the heat sink has only one stage, providing heat transfer between the substrate, the temperature of which is close to the melting temperature T_A of the lower melting component of the two-phase mixture, and the exit temperature T_L of the cooling liquid or fluid, circulating in the housing

supporting substrate base. Thus R1~$\underline{(T_A - T_L)/Q}$ [$Q/(T_A-T_L)$], where Q is the heat flux measured in watts per cm^2, ($w.cm^{-2}$), and R_1 has dimensions $\underline{cm2 \cdot {}^{o}C/w}$ [$w \cdot cm^{-2} \cdot {}^{\circ}C^{-1}$]. For example, when Q = 100 $w \cdot cm^{-2}$, and (T_A-T_L) is 500°C, the value of the thermal resistance R_1 is close to $\underline{5cm2 \cdot {}^{o}C/w}$ [0.2 $w \cdot cm^{-2} \cdot {}^{\circ}C^{-1}$].

Paragraph [0072]

The moving species in a solid oxide electrolyte fuel cell is oxygen ions and in order to obtain sufficiently high current density the fuel cell is operated at temperatures close to 1000°C. [Fuel cell devices incorporating proton exchange membranes are usually operated at around 400°C. Sodium/sulphur batteries have similar operating temperatures.] The fuel cells are often designed for operating moving, electrically driven vehicles. For the most efficient utilization of the energy generated, as well as for the safety of the driver and the passengers, isolation and insulation of the fuel cell bearing enclosure, as well as the controlled transfer of heat generated, are of great importance.